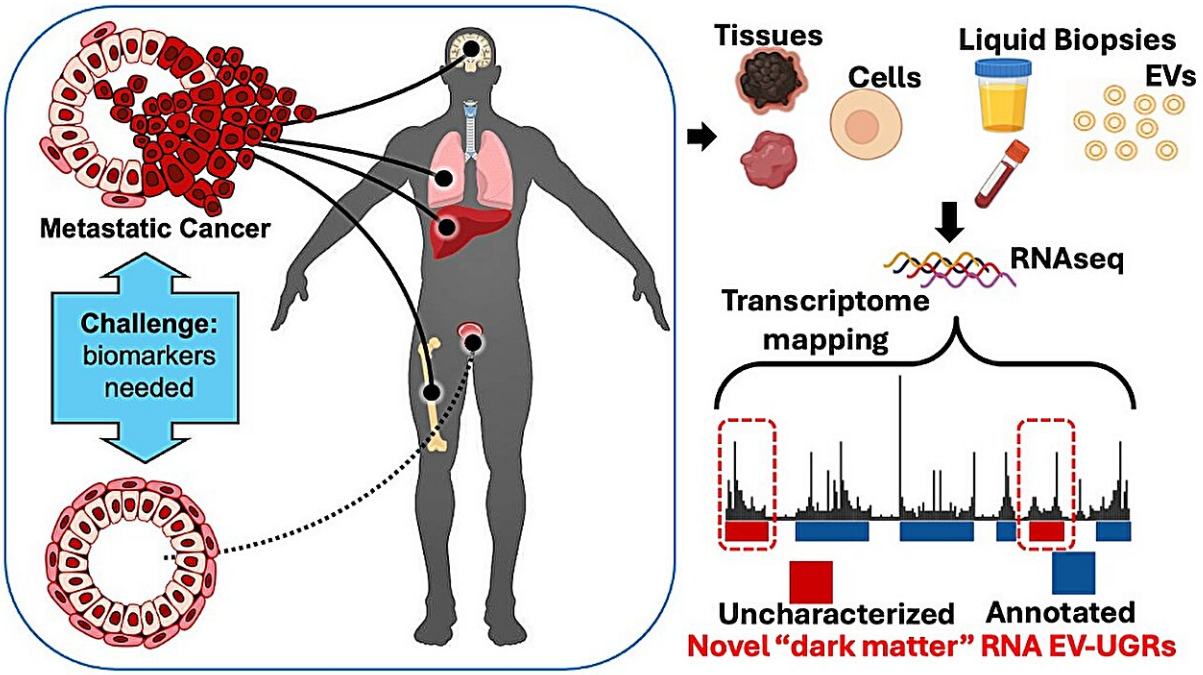
Medical Xpress

Researchers discover novel nanoparticles in blood with potential to transform cancer diagnosis

August 17 2024



Researchers at Icahn Mount Sinai found a new class of RNA in blood nanoparticles, potentially paving the way for less invasive cancer diagnosis. They used next-generation RNA sequencing and other innovative tools to develop a cost-effective liquid biopsy test to isolate and identify these novel RNA types. Credit: Laboratory of Navneet Dogra, Ph.D., Icahn Mount Sinai.

Scientists at the Icahn School of Medicine at Mount Sinai have

identified a new class of RNAs packed into tiny particles known as extracellular vesicles (EVs) that could revolutionize how cancer and other diseases are diagnosed. The team found that these molecules undergo changes when cancer is present, suggesting their potential as biomarkers for detecting prostate cancer or as targets for therapy. The work, led by Navneet Dogra, Ph.D., Edgar Gonzalez-Kozlova, Ph.D., Tzu-Yi Chen, Ph.D., and Gustavo Stolovitzky, Ph.D., published in the August 16 online issue of *Journal of Extracellular Vesicles*.

Dr. Dogra is an Assistant Professor of Pathology, Molecular, and Cell-Based Medicine, and a member of the Icahn Genomics Institute, and Dr. Gonzalez-Kozlova is an Assistant Professor of Immunology, both at Icahn Mount Sinai. Dr. Chen, a former Ph.D. student in Dr. Dogra's and Dr. Cordon-Cardo's labs, is also affiliated with the Pathology, Molecular, and Cell-Based Medicine. Dr. Stolovitzky was formerly an Adjunct Professor at Icahn Mount Sinai and a researcher at the IBM Watson Research Center in Yorktown Heights, New York.

The research team named these RNA molecules "EV-UGRs" (short for Extracellular Vesicles-Associated Unannotated Genomic Regions) after discovering them in the blood and urine of prostate cancer patients. UGRs are often referred to as the "dark matter" of the human genome. They are believed to be crucial for controlling how genes are turned on and off and how genetic instructions are translated into proteins.

Extracellular vesicles and exosomes are tiny nanoparticles, approximately 1,000 times smaller than the thickness of a human hair, secreted by all cells into biofluids such as blood and urine. These nanoparticles are known to carry genetic material, which is protected from the external environment. A collaboration between the laboratory of Dr. Dogra and Dr. Stolovitzky discovered that EVs carry these small, previously unidentified pieces of RNA dark matter.

"Until now, the RNA 'dark matter' associated with extracellular vesicles and exosomes has been largely ignored. My team wanted to explore whether EV-UGRs could be valuable for disease monitoring. We tracked prostate cancer patients before and after prostate cancer surgery and were surprised to find that EV-UGR RNA expression changed following the surgery. This is, to our knowledge, the first study to detail these 'dark matter' RNA molecules, EV-UGRs, in unprecedented detail in the context of prostate cancer," says Dr. Dogra, lead author of the study. "Our findings indicate that blood EV-UGRs undergo changes in the presence of cancer, suggesting a less invasive approach for diagnosing prostate cancer through simple liquid biopsies, potentially eliminating the need for more complex, painful, and infection-prone biopsy procedures."

"Prostate cancer is a heterogeneous disease, often requiring only active monitoring rather than treatment. Our study uses extracellular vesicle-associated novel RNA molecules as a diagnostic tool. This technology holds significant potential for less invasive diagnosis and liquid biopsy in the near future," says Ash Tewari, MD, MBBS, MCh, co-author, and Professor and Chair of the Milton and Carroll Petrie Department of Urology at Icahn Mount Sinai.

As part of the research, the investigators used next-generation small RNA sequencing to rapidly analyze human tissues and fluids. In addition, they developed a cost-effective liquid biopsy test and created tools to isolate tiny EVs from the blood and urine. Finally, they devised a computer pipeline to identify the new types of RNA.

The discovery of EV-UGRs, reports Dr. Dogra, holds promise for non-invasive diagnosis not only for prostate cancer but potentially for other diseases as well. Next, the researchers plan to validate their findings through rigorous randomized clinical trials, which will involve testing the new approach on a broader scale to confirm its effectiveness.

"This is a significant and timely achievement. The potential impact of this research is vast, promising a future where diagnosing diseases like prostate cancer could be done quickly and less invasively. This advancement could revolutionize care by reducing the time and discomfort associated with current diagnostic procedures, potentially leading to earlier detection and more effective treatment strategies, ultimately improving patient outcomes and quality of life," says Carlos Cordon-Cardo, MD, Ph.D., co-author, the Irene Heinz Given and John LaPorte Given Professor of Pathology, and Chair of the Department of Pathology, Molecular and Cell-Based Medicine at Icahn Mount Sinai.

The paper is titled "Extracellular vesicles carry transcriptional 'dark matter' revealing tissue-specific information."

More information: Navneet Dogra et al, Extracellular vesicles carry transcriptional 'dark matter' revealing tissue-specific information, *Journal of Extracellular Vesicles* (2024). DOI: 10.1002/jev2.12481

Provided by The Mount Sinai Hospital